

profound that I feel bound to call particular attention to these views, which substantially constitute objections to the taxonomic suggestions I have ventured to throw out.

6. ON DEFORMITY OF THE LOWER JAW IN THE CACHALOT
(*PHYSETER MACROCEPHALUS*, LINN.). BY JAMES MURIE,
M.D.

The great length, the graceful elegance, and the beautiful symmetry of the lower jaws, as well as the regularity of the teeth, of the common Cachalot, are often striking objects of admiration in our museums. Occasionally, however, these jaws are found deformed in a very curious manner, and in such a way as at first sight cannot readily be accounted for.

With the exception of the short graphic account given by Mr. Beale in his 'Natural History of the Sperm Whale' (1839, p. 36), I am not aware of any original description or observation on this anomalous condition; and as three examples of a well-marked kind have fallen under my notice, I have considered it might not be uninteresting to examine, as far as the specimens have permitted, their exact condition, in order, if possible, to elucidate the cause of this abnormality.

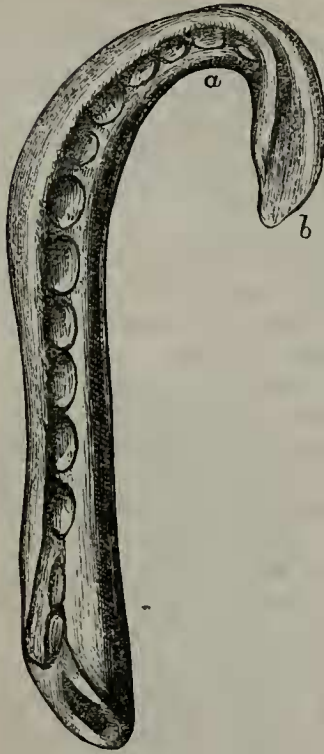
The first specimen I have to mention I saw when I was in New York a few years ago. I then paid a visit to the Museum in connexion with the United States Navy Yard at Brooklyn; and among the various curiosities exhibited I observed the right moiety of the lower jaw of a Cachalot, which arrested my attention from its peculiar shape. I made inquiries concerning the specimen, but failed to obtain any history in connexion with it.

The unusual form of this half of a lower jaw (of a comparatively speaking young animal) consisted in the symphysis and anterior half of the body being twisted at nearly right angles to the ordinary direction of the bone. The ramus was perfectly normal; and the body from thence onwards to about its middle seemed quite natural. From this latter part, however, it took a quick curve outwards almost rectangularly, then with a second larger sweeping curve it bent itself somewhat backwards, and further on towards the anterior end of the symphysis it again recurved itself a short way forwards, not unlike the manner depicted in fig. 2, of a somewhat similar-sized jaw in the British Museum.

The specimen, no. 2452, vol. ii. of the Physiological Series in the Museum of the Royal College of Surgeons*, presented by Fred. D. Bennett, Esq., F.L.S., is described in the catalogue as "The right ramus of the lower jaw of a *Physeter*, the anterior part of which is curved strongly inwards and backwards, in consequence of some injury received in youth."

* My acknowledgments are due to the Museum Committee for permission to figure this most interesting object.

Fig. 1.



This second specimen (fig. 1) is another illustration of the same kind of twisting as the one already described, and resembling it in being towards the right side; but in this case the jaw has been sawn across merely to preserve the interesting part of it; though, from the proportional size of the piece, compared with adult specimens in the same museum, one has no hesitation in referring it also to a young animal. The total length of the bone in a straight line is 23 inches, but following the curve it is as much as 33 inches. It contains nineteen sockets for the teeth. The ramus of the jaw seems normal as far forwards as the symphysis; thence inclining at a slight angle outwards for about a distance of 14 inches, it makes again a sudden sharp turn outwards, and then a second as quickly backwards, so as to resemble a hook in figure. The plane of the bone is also very much altered in position; this is best observed by following the course of the alveoli and sockets of the teeth. The extremity towards the ramus (where the jaw is cut across) has the alveolus in the natural position; but the fourth and fifth sockets forwards from this exhibit a slight inclination outwards; and this alteration of the sockets and plane of the bone goes on to the centre of the concavity of the twist, where they are no longer above, but on the middle of the side, and with a direction backwards (fig. 1 *a*). From this they still continue to alter in position to the extremity of the hook, where

the inner surface of the bone, which ought to have been in approximation with the left half, comes to be upon the upper surface (fig. 1 *b*), while the sockets are thrown round, partly looking opposite to those in the hinder part of the jaw, and partly on the under surface. The bone in this instance is increased in density, and several of the sockets for the teeth have spongy bone thrown out upon their surfaces, showing that the parts have suffered at one time or other from chronic inflammation. The bone otherwise is healthy, or such as if it had not suffered from rachitis or other softening causes.

The third example is one which gives a better idea of this anomalous condition (see fig. 2). It is a specimen contained in the Osteological Collection at the British Museum, which I was enabled to examine carefully through the kindness of Dr. Gray and Mr. Gerrard. There is no history attached to it.

The two halves of the jaw are complete, but separated from each other. Their size shows the animal to have been young, although of considerable dimensions. The length of the two, placed in juxtaposition, in a straight median line from opposite the posterior ends of the rami to the anterior surface of the bend, is about 65 inches, while the measurement following the curve of the right half to the tip of the jaw is 92 inches. Their anterior fourth has a curve towards the left side, in shape not unlike a shepherd's crook; and they have besides a twist upon themselves.

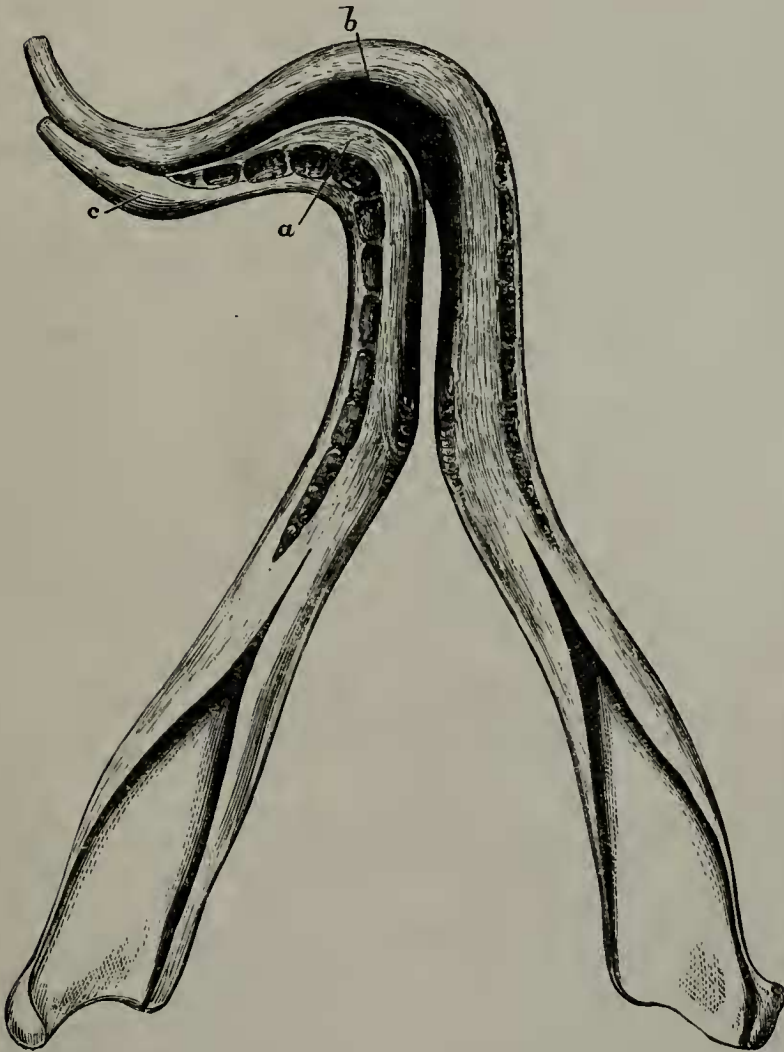
Each lateral half of this inferior maxillary bone presents characters sufficient to make it worthy of a separate description. The left has twenty-two sockets in its alveolar process. Following these as the most simple guide to the nature of the twist, we find the posterior six alveoli to be nearly on the upper surface, or in natural position; the next seven in advance (which occupy the hinder end of the symphysis) by degrees change from the upright position, so that the foremost one at the middle of the crook comes to be on the outer side of the jaw, and points directly backwards to the condyles. The four alveoli anterior to these last return gradually from the outer side to the upper surface, and the remaining five in front continue as it were in their normal position, that is, directed upwards. The bone of the jaw, besides the double angular bend, has in the mean time rolled itself outwards along with the sockets, so that the internal edge of the symphysis at the sharp bulging curve (fig. 2 *a*) is upon the upper surface; then as the bone bends backwards and outwards the symphysis returns or rolls itself inwards (fig. 2 *c*), so that at the anterior end it is first above and then comes to be almost on the inward and under surface. The symphysis has therefore a double bend and a double twist.

The pathological condition of the left half of the jaw is as follows:—The alveoli, as far forwards as the wide bend, are partially filled with spongy exostosed bone; the rest of the anterior alveoli have likewise traces of spongy bone in them, but their cavities seem rather widened than otherwise. The bone of the symphysis at the outward bend is very much augmented in breadth, thickness, and density (fig. 2 *a*); and internally it fits into a large hollow in the

bone of the right side, which last is seemingly worn into a groove by the continued pressure of the left half on it (fig. 2 *b*). Internally and below, the surface of the latter bulging part of the bone has a fibrous appearance, the lines being gently curved round, but in no way as if the jaw had been fractured or received a sudden single powerful twist. Above the last-mentioned place the surface of the bone is roughened and porous in appearance, like what is produced by periostitis. The remainder of the bone to the tip is diminished in thickness.

The right half of the inferior maxillary bone has a similar shep-

Fig. 2.



Abnormal lower jaw of *Catodon* (*Physeter macrocephalus*, Linn.) in the British Museum.

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herd's crook-like bend to the left side. Its six posterior alveoli are normal in position ; the seven or eight anterior to these incline outwards to the middle of the side, and the two most advanced of these last have a direction directly forwards, therefore quite in an opposite manner to their fellows of the left side. The remaining front alveoli of the right side, from being placed laterally, curve back almost to the vertical.

The posterior sockets forwards to where the bend begins, as in the left half, are lined with spongy exostosis ; but on the outer surface of the bend itself, the alveolar cavity becomes exceedingly shallow and superficial, and three sockets at this place are nearly obliterated ; what cavities remain are merely narrow lengthened slits. The next three alveoli anterior to the bend are all but filled with bony matter, and those still more in advance have a similar deposition, but in smaller quantity.

The inner surface of the symphysis at the bend, as already noticed, is scooped out (fig. 2 *b*), and the wall of the bone at this part is worn to a mere shell ; but forwards from this the bone is much more dense and solid.

Hence from this it results, that besides the difference in the direction of the alveoli in the two halves of the jaw, they also differ in the right being hollowed and atrophied at the bend and normal in density at the anterior part of the symphysis ; while, on the other hand, the left side has its bend considerably hypertrophied, with the tip atrophied.

Of such rather extraordinary conditions of the lower jaw Beale, as previously referred to, says :—

“ Besides blindness, this Whale is frequently subject to deformity of the lower jaw, two instances of which I have seen myself, in which the deformity was so great as to render it impossible for the animal to find the jaws useful in catching such fish, or even, one would have supposed, in deglutition ; yet these Whales possessed as much blubber and were as rich in oil as any of a similar size I have seen before or since.

“ In both these instances of crooked jaws the nutrition of the animal appeared to be equally perfect ; but they were different, in one case the jaws being bent to the right side and rolled as it were like a scroll ; in the other it was bent downwards, but also curved upon itself.

“ It would be interesting here to inquire into the cause of this deformity ; but whether it is the effect of disease or the consequence of accident I am unable to determine.

“ Old whalers affirm that it is caused by fighting. They state that the Sperm Whales rush head first one upon the other, their mouths at the same time wide open, their object appearing to be the seizing of their opponent by the lower jaw, for which purpose they frequently turn themselves on the side ; in this manner they become as it were locked together, their jaws crossing each other, and in this manner they strive vehemently for the mastery.

“ I have never had the good fortune to witness one of these com-

bats; but if it be the fact that such take place, we need not wonder at seeing so many deformed jaws in this kind of Whale, for we can easily suppose the enormous force exerted on these occasions, taking into consideration at the same time the comparative slenderness of the jaw in this animal. Some corroboration of the above statement arises from the fact, as far as my knowledge extends, that the female is never seen affected with this deformity."

From this it seems Mr. Beale is in doubt whether the deformity arises from disease or is the effect of accidental injury, almost inclining, however, to refer it to the latter; but this is, in a great measure, founded on hearsay evidence.

Without entering into the question of the nature or in what manner the food is obtained by these deformed Cachalots, if we inquire what, most likely, has given rise to the jaws assuming their curious shape, in the absence of definite information we must take into consideration the condition of the bones themselves. This leads us to assign it to one of the three following causes:—first, congenital malformation; secondly, direct accidental injury; and thirdly, disease.

With reference to the first of these causes, I believe we are justified in concluding it not to be a congenital condition, as the consistency of the osseous tissue in the specimens does not present such characters as would indicate that while in the foetal state, or in the after young stage of the animal, the bone had suffered from softening disease, such as rachitis; thus inherent defect or malnutrition in the constituents of the bony particles themselves is not observable. Again, in the mere deviation of form there would not necessarily be such coexistent and extensive marks of recent inflammatory action; for the deformed parts at a very early age would have accommodated themselves to their anomalous position.

As regards the second cause, we are enabled to state with certainty that there is no trace of direct fracture of the bones; so that in whatever manner the turn or curve has been produced, it evidently has not taken place by a single, sudden, sharp twist of the jaw into its present position, as might be inferred from what Mr. Beale tells of the manner these Whales are said to fight.

From these reasons, therefore, the third cause would seem to be the most probable one, although it is difficult to prove, from the paucity of specimens, that disease of the bone has undeniably been the originating cause; for it is not unlikely that some sudden shock or slight injury may have excited or accelerated the disease, as well as that it should have arisen from pure inherent pathological conditions.

At all events the state of the bones themselves demonstrates, and this most clearly in the last-described specimen, that they have undergone a long-continued process of inflammation (*ostitis*), which has given rise to their becoming condensed and indurated in texture at one place, while in another there has been a corresponding rarefaction, the hypertrophied bone of the left side seemingly having slowly increased and worn the large hollow for itself, which it occupies in the right ramus, as this last, subjected to the continued pres-

sure, has evidently been atrophied to such an extent that little more than a mere shell of bone is left at the bend.

Inflammation of the periosteum (*periostitis*) has likewise occurred, as may be inferred from the appearance and consistence of the spongy bone thrown out on the surface. The gums, sockets of the teeth, and the large nerves sent to the long jaw have also been more or less severely implicated; and the manner in which the occlusion of the alveoli has taken place, together with, at one place, the apparent gradual diminution of the vascular supply by the regular channels from pressure upon the vessels, all point out that no sudden bend has been the means of producing the deformity, or that it has been an original foetal malformation.

On the whole, then, I would be inclined to account for the distortion of these jaws by supposing that when the creature was yet very young, its bones more or less soft or cartilaginous, a state of chronic inflammation had been set up in the bones and periosteum just at the bend, either inherently in the substance or from the effects of a concussion. The inflammatory process, continuing for a lengthened period, would give rise to enlargement and induration of the osseous tissue at the point mentioned, and according to the amount of local irritation and fresh deposition of osseous tissue would the abnormal curve of the bone be produced. The manner in which inflammation of the hoof in Ruminants occasionally causes it to curl upwards may be taken as a familiar example; only in the case of the jaws of the Cachalot the increase of growth and swerving of the bone from its usual direction would be effected by the hypertrophy of the one side pressing against and being reflected from its fellow, which it at the same time would drag along with it, while the increase and corresponding diminution of substance at the different points would produce the twist upon itself which each ramus possesses.

P.S. Since the above was written, Mr. Flower has informed me that he has seen a lower jaw of a small Cachalot distorted in a manner similar to those above described, though less curved. The specimen is in the Museum of the Literary and Philosophical Society of Hull. Along with the two instances recorded by Mr. Beale, this would make a total of six authenticated cases of deformity, and four, *at least*, of these occur in animals not full grown, but whether males or females is uncertain, excepting the British Museum specimen, which may be considered a female. For I find, according to Professor Owen (*Odontography*, pp. 353, 354), that in this species of Cetacean the difference of sex is easily distinguishable by the lower jaws alone, the male having twenty-seven, while the female has only twenty-three, teeth in each ramus, and the size of the jaws in the latter is also a third shorter. The fact of one specimen, therefore, being a female would invalidate Mr. Beale's corroboration of this deformity only taking place in the fighting males.
